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# A Major North American Range Extension for the Forked Spleenwort, Asplenium septentrionale

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The "Forked Spleenwort," *Asplenium septentrionale* (L.) Hoffm., is a very unusual Spleenwort and one of the most striking ferns in the American flora. Presumably because of its peculiarly attenuated leaves (*Fig. 1*), the plant was recently referred to by Darling, (1964, p. 200) as an "oddity." Nevertheless it is a very wide ranging plant. Its distribution in western North America has been summarized by Lang (1969), who found the species recently for the first time in Oregon. Because of its "striking resemblance to tufts of grass" and its tendency to occur in very localized populations, it probably occurs in other as yet undiscovered places in the western United States; at present it is known there from the eastern slope of the Rockies from South Dakota and Wyoming south to western Oklahoma, New Mexico, Arizona, and Baja California. In the Old World, Broun (1938) reports it from the British Isles, Europe, northern Asia, and the Himalayas. Of the seven species of Spleenworts known in Britain, Manton (1950, p. 98) writes that "The rarest is *Asplenium septentrionale* . . ., a plant of southern affinities only found in a few presumably relict localities in the mountains of England, Scotland, and Wales." The habitat given by Broun is "sheltered crevices in cliffs of igneous rocks."

During the second term of the 1970 summer session at Mountain Lake Biological Station of the University of Virginia, I was enrolled in the Pteridology course which has been taught there since 1961 by Dr. Warren H. Wagner, Jr., of the University of Michigan. A major emphasis in this course is upon student research in the field and laboratory. Accordingly, on August 2, 1970, a committee from

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Bluff in Monroe Co., West Virginia, where A. septentrionale Grows

the class, consisting of Carolyn Crump, Ronald and Shirley Fortney, Lewis Morgan, and me, began a pteridological survey of Monroe County, in southeastern West Virginia. This county, which is adjacent to Giles County, Virginia (the location of the Biological Station), seemed especially promising for field exploration because the class had already visited locations there discovered by E. T. Wherry during the late 1930's for *Phegopteris connectilis* and *Lycopodium porophilum*, which are growing at this southern latitude at unusually low elevations for these northern plants.

While we were climbing on the upper slopes of a bluff of loose, strongly brittle shale above a stream (*Plate 16*), we noticed what appeared to be several tufts of a small grass or sedge growing from crevices in the exposed, brightly sunlit, and extremely dry shale. In color, size, and texture, the narrow leaf tufts also seemed quite similar to bunches of pine needles. Closer examination revealed, however, that these "needles," some of which were four inches long, were actually slightly expanded near their tips and forked. They bore on their undersides unmistakable fern sporangia. Having seen *Asplenium septentrionale* on the American Fern Society Colorado Foray in 1964, I quickly realized that we had made a remarkable discovery. Consultation of the literature indicated that our plants were nearly 1,200 miles from the nearest known station in western Oklahoma.

When Dr. Wagner and the entire class visited the area on the following day, we counted sixty plants from four to nearly 40 feet above the stream level on the northwest-facing bluff. Diligent searching up and down the stream revealed five more plants on another cliff about one-fifth of a mile upstream. One of the latter plants is shown in *Figure 1*, growing from the same crevice as *A. platyneuron*.

As these plants on both cliffs were of all ages, the populations are definitely reproducing. Unless some calamitous disturbance takes place, the ferns should be able to maintain themselves indefinitely. We have no idea how old the populations are. It is entirely possible that other stations will be discovered, as there are numerous similar habitats nearby.

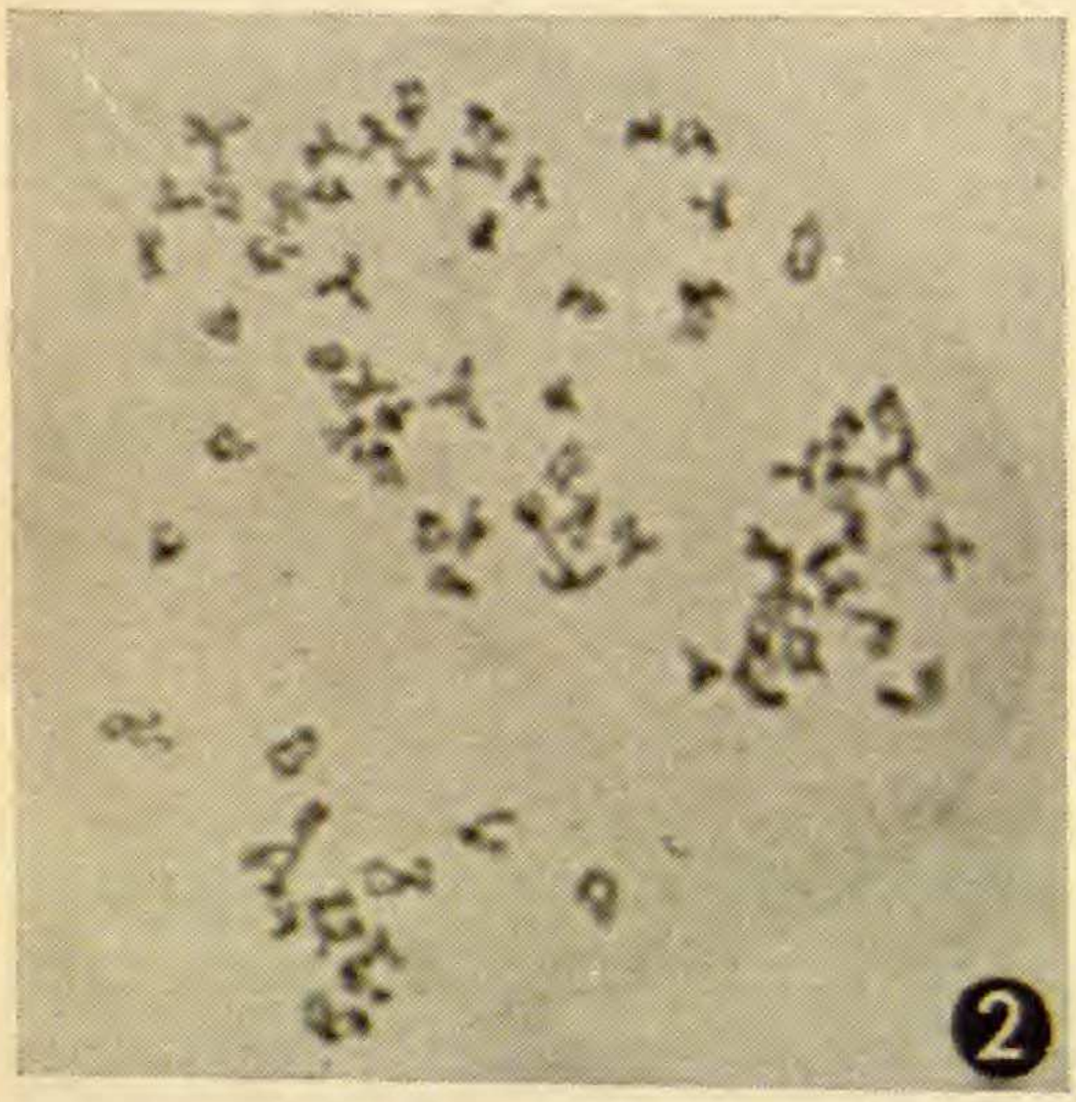

FIG. 1. ASPLENIUM SEPTENTRIONALE (ABOVE) GROWING FROM SAME CREVICE AS A. PLATYNEURON (BELOW). FIG. 2. CHROMOSOMES OF A. SEPTENTRIONALE AT MEIOTIC METAPHASE. FIG. 3. SAME, CAMERA LUCIDA INTERPRETATION.

Because of its great disjunction and the possibility that the local populations have become differentiated, we were especially interested in determining the chromosome number. Manton (1950, p. 98ff.) reported that *A. septentrionale* in Great Britain is tetraploid ($n = 72$ pairs at diakinesis). Cytological preparations of the plants we obtained, made by Dr. Florence S. Wagner, showed unmistakeably the same number (*Figs. 2, 3*).

The "Septentrionale Bluff," at an elevation of about 2100 feet, is shown in *Plate 16*. It supports only a sparse vegetation. Trees include *Pinus virginiana*, *P. strobus*, *Quercus prinus*, *Q. ilicifolia*, *Betula lenta*, and *Robinia pseudoacacia*. Among the shrubs are *Vaccinium vacillans*, *Kalmia latifolia*, *Rhus radicans*, and *Parthenocissus quinquefolia*. The herbs *Aquilegia canadensis*, *Houstonia longifolia*, and the attractive *Campanula divaricata* are in evidence here, the last in bloom at the time of our discovery of the fern. The loose shale is extensively covered by a variety of lichens (especially such fruticose types as *Cladonia rangiferina*) and a few mosses, including *Polytrichum* spp. and *Leucobryum glaucum*.

Ferns associated with the Forked Spleenwort are *Asplenium trichomanes* and *A. platyneuron*. In Great Britian and Europe *A. septentrionale* hybridizes with the first to yield *A.* × *germanicum* (Manton, 1950, p. 100ff.). This is the first time that *A. septentrionale* and *A. platyneuron* have been reported growing together. No hybrid plants of the latter parents have yet been discovered.

A number of fronds collected from several plants on both days of our visits (*Emory 70019, 70020*) have been distributed to the following herbaria: US, GH, NY, MICH, WVA, and TENN. More precise information on the location in Monroe County, West Virginia, is not being published in the hope that the population can be protected. I do not feel that there is a need for oversampling, and I wish to urge the greatest caution in maintaining these plants in their natural state without disturbance.

This report of *Asplenium septentrionale* in the Appalachian region constitutes a new addition to the flora of the eastern United States. The significance of disjunct eastern localities for western fern species will be discussed in another paper.

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# Hard Water as a Limiting Factor in the Distribution of Isoëtes echinospora

LEROY LEE AND FRANCES BELKNAP

*Isoëtes* in Wisconsin has been shown by Swindale and Curtis (1957) to be a typical member of the soft water flora. Tryon et al. (1953) show it distributed in soft water areas, but absent from areas where hard water lakes are common. Moyle (1945) reports the Quillworts in Minnesota as members of a flora limited to a single chemical type: the soft water lakes found in the northeastern portion of the state.

Although soft water is the typical location of Quillworts, they have been found in hard water. Lee reports *Isoëtes echinospora* from Moshawquit lake. This Wisconsin lake has a specific conductance of 173 micromhos/cm and a total alkalinity of 98 mgm/l $CaCO_3$, which exceeds the upper limit of tolerance as reported by Moyle (1945). Seddon (1965) reports it in two hard water lakes in Wales, Llyn Llygerian and Llyn Llywenan.

Moyle (1945) suggests that the aquatic species of *Isoëtes* are found in soft water because they can not tolerate a total alkalinity